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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/750,488	12/31/2003	Eric C. Hannah	P18191	1800
21186	7590	09/30/2005	EXAMINER	
SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH 1600 TCF TOWER 121 SOUTH EIGHT STREET MINNEAPOLIS, MN 55402			HAFIZ, MURSALIN B	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 09/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary

Application No.

10/750,488

Applicant(s)

HANNAH ET AL.

Examiner

Mursalin B. Hafiz

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– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-37 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12, 14-28 and 30-37 is/are rejected.
- 7) ☒ Claim(s) 10, 13, 16 and 29 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claims 10 and 16 are objected to because of the following informalities:

In claim 10 it reads "formed n the". For this office action it is treated as "formed on the".

Claim 16 refers to back to claim 14 for wiring board. For this office action 16 is treated as dependent up on claim 15 since a wiring board is not mentioned in claim 14 or claim 1.

Appropriate corrections are required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-3, 6-11, 14, 30, 31, and 33-37 are rejected under 35 U.S.C. 102(e) as being anticipated by Searls et al (US 6,856,016 B2).

Regarding claim 1 Searls discloses, an apparatus comprising:

A thermal management device [24];

A heat source [12]; and

An interface [26] disposed between the thermal management device [24] and the heat source [12], the interface having a plurality of nanostructures [column 2 line 6-7].

Regarding claims 2 and 3, Searls discloses thermal management device [24] comprises a passive cooling device and passive cooling device comprises at least one of a heat sink, a heat spreader, heat pipes and a heat slug [column 1 line 60-63].

Regarding claim 6, Searls discloses that the heat source [12] comprises an integrated circuit (IC) die [column 1 line 49-52].

Regarding claim 14, Searls discloses nanostructures comprises a plurality of carbon nanotubes [28, column 2 line 7].

Regarding claim 30 Searls discloses, a package comprising:

A thermal management device [24];

A heat source [12]; and

An interface [26] disposed between the thermal management device [24] and the heat source [12], the interface having a plurality of nanostructures [column 2 line 6-7].

Regarding claim 31, Searls discloses thermal management device [24] comprises a passive cooling device [column 1 line 60-63].

Regarding claim 33, Searls discloses that the heat source [12] comprises an integrated circuit (IC) die [column 1 line 49-52].

Regarding claims 7-11, and 34-37, the limitations "interface comprises a plurality of nanostructures formed on the thermal management device, interface comprises a

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plurality of nanostructures formed on the heat source, plurality of nanostructures formed on the thermal management device being coupled to the plurality of nanostructures formed on the heat source, plurality of nanostructures disposed in predetermined manner to facilitate coupling of the plurality of nanostructures formed on the thermal management device with the plurality of nanostructures formed on the heat source, and the plurality of nanostructures formed on the thermal management device and the plurality of nanostructures formed on the heat source have a plurality of molecules covalently coupling the nanostructures” are drawn to a process by which the product is made. Note that a “product by process” claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a “product by process” claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in “product by process” claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 4, 5, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Searls et al (US 6,856,016 B2) in view of Chen et al (US 2005/0059238 A1) herein after Chen(2005).

Regarding claim 4, 5, and 32, Searls met all the claimed limitations except, the thermal management device comprises an active cooling device, and the active cooling device comprises at least one of an air jet impingement device and a dielectric liquid device. However, Chen(2005) teaches active cooling device can be substitute for a passive cooling device [page 4 paragraph 0039]. So, it would have been obvious to one of ordinary skill in the art at the time of invention to use active cooling device instead of passive cooling device to increase the efficiency of the thermal management device. Chen teaches thermal management device being air jet impingement device [micro-fan device, micropumps] [page 4 paragraph 0039].

4. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Searls et al (US 6,856,016 B2) in view of Chen et al (US 2004/0125565 A1) herein after Chen(2004).

Regarding claim 12, Searls met all the claimed limitations except the plurality of molecules comprises a flexible polymer molecule. Chen(2004) teaches a thermal interface [40] material comprising a flexible polymer [page 2 paragraph 0018] molecule. Polymer materials provide improved thermal contact for nanostructures to the heat source and heat management device [page 2 paragraph 0019]. So, it would have been

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obvious to one of ordinary skill in the art at the time of invention to use polymer matrix instead of paste at least for high thermo conductivity.

5. Claims 15,17-19, and 22-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prasher (US 2005/0105272 A1) in view of Searls et al (US 6,856,016 B2).

Regarding claims 15, Prasher discloses in Fig. 6b, a system comprising:

- a wiring board [610];

- a memory device electrically coupled to the wiring board [610] [page 3, paragraph 0037];

- a heat source [624] electrically coupled to the wiring board [610];

- a thermal management device [622 and 602 combined] coupled to the heat source [624]; and

- an interface [626] disposed between the thermal management device [622 and 602 combined] and the heat source [624].

Prasher does not disclose that the interface having a plurality of nanostructures. However, Searls teaches an interface having a plurality of nanostructures [column 2 line 6-7]. Nanostructures such as carbon nanotubes have high thermal and electrical conductance. So, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to use nanostructures in the interface at least to increase the thermal conductivity or ground the die [Searls abstract].

Regarding claim 17, Prasher discloses that the memory device comprises a flash type memory device [page 3, paragraph 0037].

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Regarding claims 18 and 19, Searls discloses thermal management device [24] comprises a passive cooling device and passive cooling device comprises at least one of a heat sink, a heat spreader, heat pipes and a heat slug [column 1 line 60-63].

Regarding claim 22, Prasher discloses that the heat source [624] comprises an integrated circuit (IC) die [page 3 paragraph 0035].

Regarding claims 23-27, the limitations "interface comprises a plurality of nanostructures formed on the thermal management device, interface comprises a plurality of nanostructures formed on the heat source, plurality of nanostructures formed on the thermal management device being coupled to the plurality of nanostructures formed on the heat source, plurality of nanostructures disposed in predetermined manner to facilitate coupling of the plurality of nanostructures formed on the thermal management device with the plurality of nanostructures formed on the heat source, and the plurality of nanostructures formed on the thermal management device and the plurality of nanostructures formed on the heat source have a plurality of molecules covalently coupling the nanostructures" are drawn to a process by which the product is made. Note that a "product by process" claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new

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method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear.

6. Claims 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over over Prasher (US 2005/0105272 A1) and Searls et al (US 6,856,016 B2) as applied to claims 15 and 18 above, and further in view of Tobita et al (US 6,730,731 B2).

Regarding claim 16, Prasher and Searls met all the claim limitations except, the wiring board comprises a printed circuit board. However, Tobita teaches an analogous device where printed circuit board is used in place of wiring board. It is well known in the art to use printed circuit board for putting all the components together such as motherboard of computer that contains processor with heat sink, memory etc.

7. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over over Prasher (US 2005/0105272 A1) and Searls et al (US 6,856,016 B2) as applied to claims 15 and 18 above, and further in view of Chen et al (US 2005/0059238 A1).

Regarding claim 20 and 21, Prasher and Searls met all the claimed limitations except, the thermal management device comprises an active cooling device, and the active cooling device comprises at least one of an air jet impingement device and a dielectric liquid device. However, Chen teaches active cooling device can be substitute for a passive cooling device [page 4 paragraph 0039]. So, it would have been obvious to one of ordinary skill in the art at the time of invention to use active cooling device instead of passive cooling device to increase the efficiency of the thermal management

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device. Chen teaches thermal management device being air jet impingement device [micro-fan device, micropumps] [page 4 paragraph 0039].

8. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Prasher (US 2005/0105272 A1) and Searls et al (US 6,856,016 B2) as applied to claim 27 above, and further in view of Chen et al (US 2004/0125565 A1) herein after Chen(2004).

Regarding claim 28, Prasher and Searls met all the claimed limitations except the plurality of molecules comprises a flexible polymer molecule. Chen(2004) teaches a thermal interface [40] material comprising a flexible polymer [page 2 paragraph 0018] molecule. Polymer materials provide improved thermal contact for nanostructures to the heat source and heat management device [page 2 paragraph 0019]. So, it would have been obvious to one of ordinary skill in the art at the time of invention to use polymer matrix instead of paste at least for high thermo conductivity.

Allowable Subject Matter

Claims 13 and 29 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: Prior art does not teach interface comprising polymer wherein polymer comprises deoxyribonucleic acid (DNA) molecules.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mursalin B. Hafiz whose telephone number is 571-272-0237. The examiner can normally be reached on m-f 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

mbh


GEORGE ECKERT
PRIMARY EXAMINER